CASE STUDY MATERIALS

ALU Power Co.

ALU was founded 40 years ago. Until recently, ALU operated as a Hydroelectric Power based utility, but it acquired two coal-fired power plants to expand its generation capacity. ALU is a fully integrated utility and has generation, transmission, and distribution operations. ALU's currently structure consists of the Hydroelectric Division, the Thermal Power Division, a Transmission and Distribution Division and Corporate Support (services to power consumers and to other divisions).

General Description of How Power is Generated

In very simple terms, electricity is produced by spinning electro-magnets inside a coil of wire in a generator to create a flow of electrons. To keep the electro-magnets spinning, a hydroelectric station uses falling water. Here is how it works:

Most hydroelectric stations use either the natural "drop" of the river or build a dam across the river to raise the water level and provide the drop needed to create a driving force. Water at the higher level (the forebay) goes through the intake into a pipe, called a penstock, which carries it down to the turbine. The turbine is a type of water wheel.

The turbine is connected to a generator. When the turbine is set in motion, it causes the generator to rotate, and electricity is produced. The falling water, having served its purpose, exits the generating station through the draft tube and the tailrace where it rejoins the main stream of the river.

In a thermal power station, fuel such as coal or natural gas is burned in a boiler to convert water to steam. The steam is then directed, under high pressure, into a steam turbine, which turns the turbine shaft. This shaft is connected to an electrical generator and produces electricity as it turns. A condenser converts the spent steam from the turbine back to water, which is then reused in the boiler. The condenser cooling water comes from the reservoir and is returned for reuse.

Generating Facility Characteristics for ALU

The organization to be used in this case study, the ALU Power Co., is a relatively small utility with two primary hydroelectric generating sites and two thermal generating stations as well as a customer based of 1,000,000 in a single area of a mid-western state.

ALU's operating plan is to use the thermal power stations for its base load and the hydro electric stations for peaking (peak loads are typically in the late afternoon and on an seasonal

basis winter loading peaks are higher than summer. ALU is actively involved in selling and buying power on the mid-western grid and as a commercial utility is always looking for ways to improve efficiency and be a seller when possible on days when the spot market for power is up. ALU does have a number of industrial contracts and over the year sells 5% more power than it generates.

The Hydro Electric Division

This division includes two primary hydroelectric operations based on two different watersheds with a number of associated smaller control structures.

HG1 was built in the early 1950s and has a capacity of 500 MW (Mega watts) over 8 units. Water from two other river systems was diverted for this project and the reservoir for the project is used for multiple recreational and navigational purposes. There are a number of communities downstream of the generating plant that use the river for drinking water, as well as a Native American group that retains fishing rights. The plant is undergoing a 10-year plan to refurbish its generating units and upgrade systems in general.

HG2 was built in the late 1960s and has a generating capacity of 300 MW in three units. This state-of-the-art Station is one of the last hydroelectric plants built in the state. In fact, no more economically viable hydroelectric projects have been identified in this state.

Thermal Power Division

Thermal electricity generation plant 1 (TEG1) is located on the outskirts of a city of 150,000 people. The plant generates 300 Megawatts (MW) of power through the combustion of soft coal. The coal comes from an open pit mine 20 miles away.

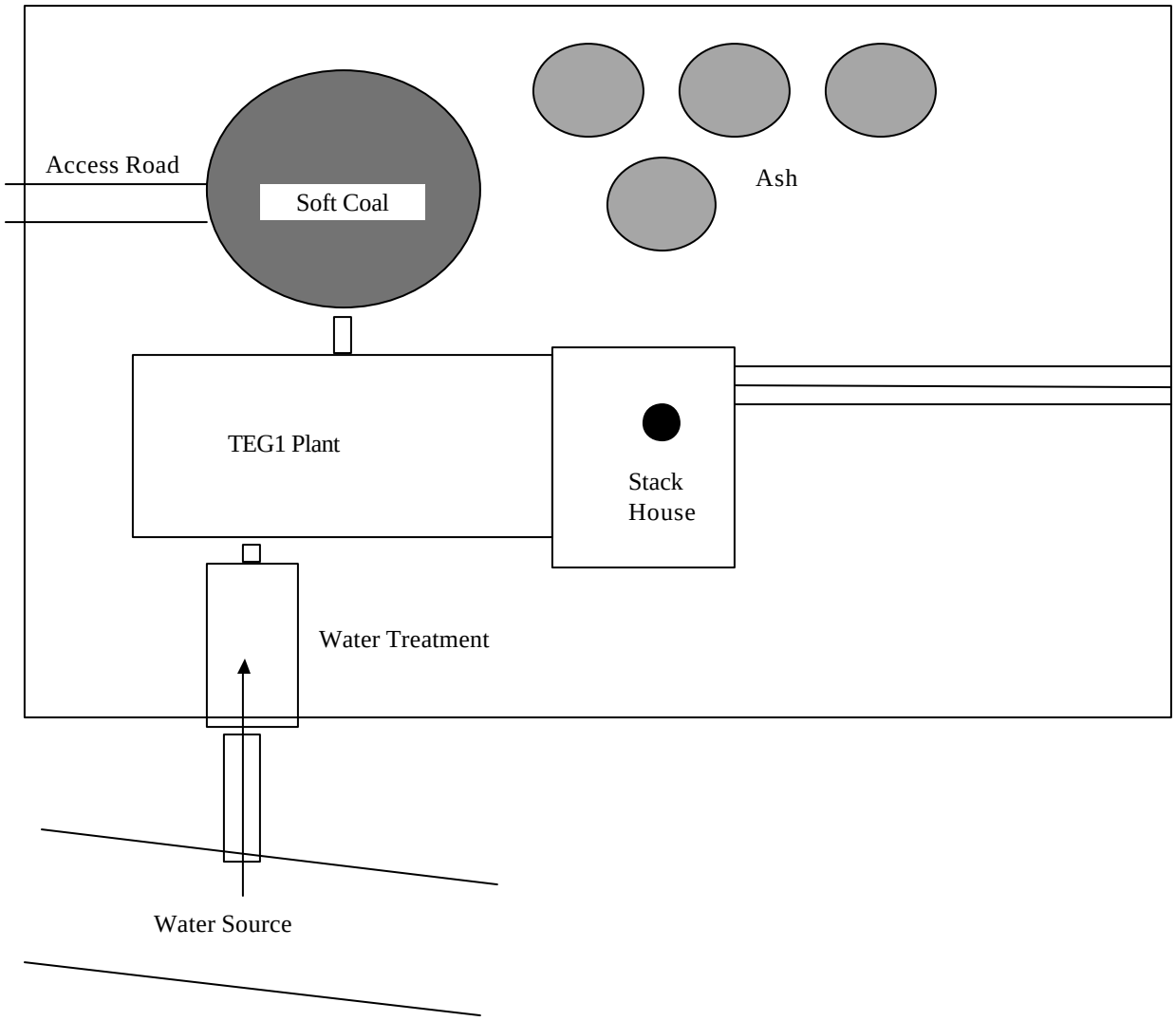
The site consists of the TEG1 plant with one stack, a soft coal storage area, four ash pits (ponds) and a primary water treatment plant (see fig. 1).

The TEG1 plant is a conventional steam power plant. The conventional steam plant is a mature technology used widely throughout the world. It consists of:

- A steam generator (boiler);
- A steam turbine; and
- Particulate removal equipment; electrostatic precipitator (ESP).

Overall plant efficiency is in the ranges from 34 to 38 percent. Supercritical, double reheat steam plants have been used in some countries (Denmark and Japan) and have achieved efficiencies ranging from 38 to 42 percent.

Figure 1: ALU TEG1 Generating Facility Site



Steam plants can burn all types of coals, oil, natural gas, and biomass independently or in combination. However, the power plant needs to be designed for the available fuels. The TEG1 plant has been designed to burn coal and has been fine tuned for the soft coal from the open pit mine area in the same state (the utility was once a part owner of the mine when it was still a fully regulated utility partially owned by the state). Electrostatic precipitation equipment for the removal of particulate has been installed on site. The process of electrostatic precipitation involves charging the particulate by forcing the dirty air through a corona (an area in which gaseous ions flow). Electrically charged plates then attract the oppositely charged particles like a magnet. Removal efficiencies are very good for particles up to 10 microns in size.

The primary water treatment plant consists of screening and filtration and other physical processes to remove suspended solids from water drawn from a local river. This treated water is used as a feed stock to generate the steam that powers the turbine.

The plant while using the local river as a water source does not use it as a heat sink due its low flows; instead it uses evaporative cooling towers.

Overview of TEG1 Technological Considerations

Pre-Combustion - Technologies that are utilized in the process before coal is burned to produce energy. These advanced methods employ chemical, biological or other techniques to remove high percentages of sulfur and ash, or they improve the effectiveness of physical coal cleaning or washing. In coal cleaning the coal is crushed and screened from impurities. Further processing utilizes the different gravities of coal and impurities to separate them in a liquid medium. Coal washing reduces the ash content and ash variability of coal used in thermal power plants leading to consistent boiler performance, less maintenance, and reduced emissions.

Combustion - Technologies that remove pollutants inside the combustor or boiler while the coal burns. Most research in this area has focused on atmospheric (AFBC) and pressurized (PFBC) fluidized bed combustion, advanced combustors, and limestone injection multi-stage burners (LIMB). All of these offer varying degrees of enhanced reduction of sulfur dioxide and/or nitrogen oxide emissions, while also improving efficiency. AFBC boilers operate at normal atmospheric pressure while PFBC boilers operate at pressures 6 to 16 times higher than normal. PFBC boilers potentially offer higher efficiency, reduced operating costs, and fewer waste products.

Post-Combustion - Technologies that clean flue gases emitted from coal burning. They are generally located in the ductwork leading to the smokestack, or in innovative versions of flue gas desulfurization systems, commonly called "scrubbers." Scrubbers can remove more than 90 percent of the sulfur dioxide emissions from coal combustion. The flue gas is sprayed with a slurry of water and an alkaline agent usually lime or limestone. The sulfur dioxide reacts chemically, forming calcium sulfate or calcium sulfite, which is removed and disposed of as a wet sludge.

Coal is defined in terms of key properties that affect the design, operation, and economics of power plants. According to the International Coal Classification, there are two types of coals: hard coals and soft coals

Hard Coal is defined as coal with a gross calorific value of **more than** 5,700 Kcal/kg (10,260 Btu/lb or 23.86 MJ/kg) on moisture, ash-free basis.

Soft Coal is defined as coal with a gross calorific value of **less than** 5,700 Kcal/kg (10,260 Btu/lb or 23.86 MJ/kg) on a moisture, ash-free basis.

TEG2

ALU's second thermal power station TEG2 has three units each slightly larger with a total Capacity of 475 MW. TEG2 is located 100 miles downstream of HG1 and is located on the outskirts of a population Center of 600,000. It uses the river as its heat sink.

TEG2 was built in stages as the city grew with the most recent unit being commissioned in 1989. The units were designed for soft coal but unit 2 has been converted to natural gas use in the same boiler chamber with Oil as a backup system for this unit. This type of conversion to natural gas is the least capital intensive, but proportionally has the highest NO_X and other emissions per MW generated. ALU is venturing into the use of natural gas as a result of pressure from the local Citizens Action Coalition and other community groups.

Transmission and Distribution Division

How the Electricity Delivery System Works

Electricity is produced in generating stations around the state and delivered to end-use customers on wires through the high voltage "grid" transmission system (owned and operated by ALU, and identified in most areas by high steel towers), and lower voltage distribution system (lines and poles that run down roads/streets and connect to people's homes). In some more densely populated areas distribution lines and transformers are buried underground.

ALU also owns and operates transmission line ties (called "interconnections") with neighboring utilities in and outside the state for "import and export" of electricity.

At each level of the delivery system, power voltage is "stepped down" or reduced at transformer stations. At the low end of the system, power is stepped down on transformers mounted on poles before entering homes and small businesses.

ALU has a number of work centers where T and D staff is based. These work centers are the overnight storage locations for vehicles, house the service centers for equipment, and function as storage locations for transformer and other electrical equipment, as well as pole storage locations.

The division overseas the siting, construction, and maintenance of transmission corridors with a new transmission corridor being required once every 3 years on average as the states population grows. Due to the sporadic nature of line construction this function uses both in house staff and a number of contracting organizations.

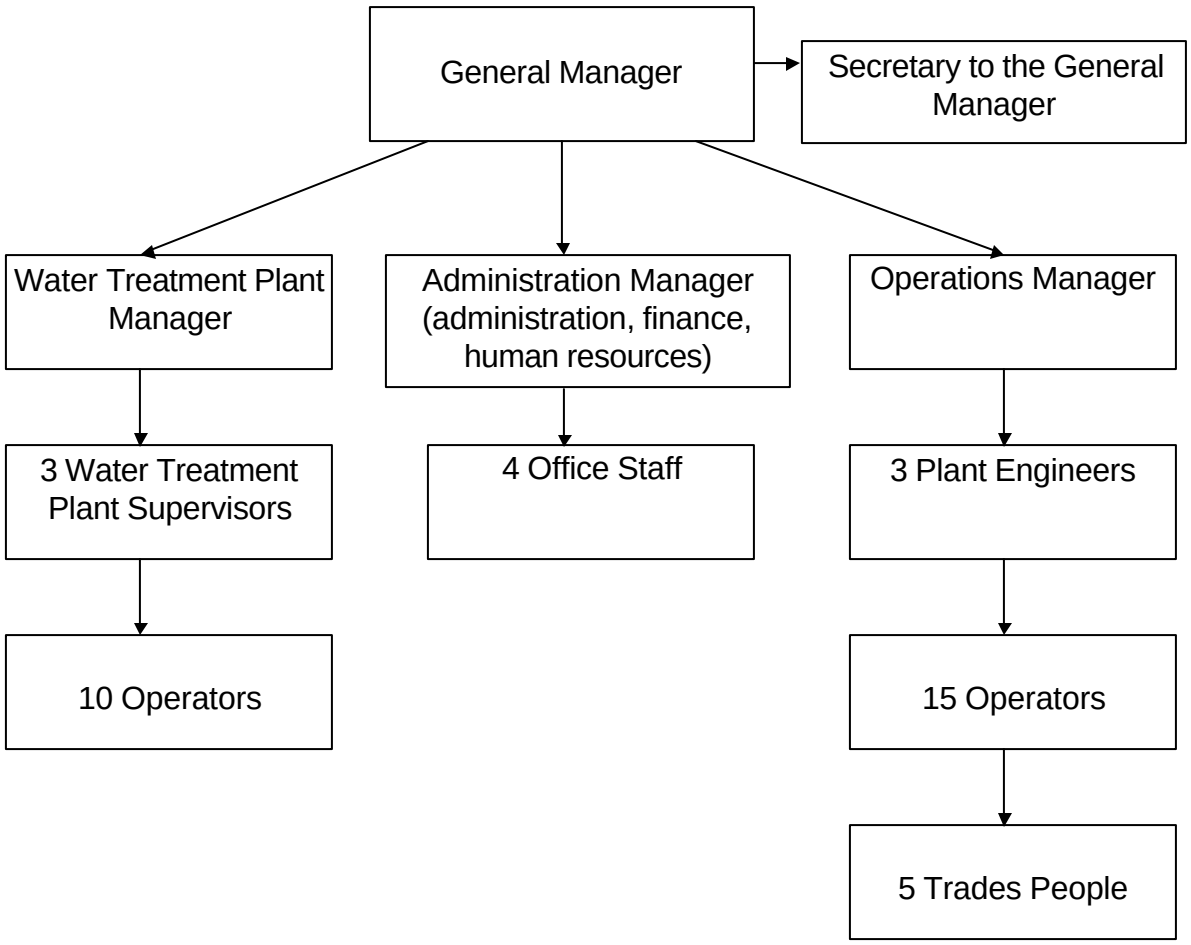
The distribution system involves crews that work both from the service centers and with trucks going home with staff overnight
Corporate Support

Corporate support includes all of the accounting and billing functions that operate at the head office as well as each service center (which serve as clearing points for customer service).

Corporate includes the grid control center (the key operational room directing all generating capacity which interfaces with the mid-western grid), engineering services (organizes projects like the refurbish and upgrade program at HG1), and environmental health and safety support.

Various administrative functions such as HR, and all purchasing (from office supplies to fuel for the thermal stations) are centralized.

Typical ALU Power Co. Organizational Chart For a Power Plant



Exercise 1

Group 1

Your task is to consider arguments for a single EMS for all of ALU.

Based on the information you have on ALU and would expect to find, what are the benefits of this approach both from the perspective of building the EMS and then maintaining it in the long run.

Consider:

The way the organization is physically laid out and also functions as an organization.

The kind of businesses they are in and how they interact with the rest of the world.

For a presentation describe in a few bullets how your group would ensure that such a company-wide EMS would work in general terms.

Exercise 1

Group 2

Your task is to consider arguments for separate EMSs based on a common model for each of the main operating divisions at ALU.

Based on the information you have on ALU and would expect to find, what are the benefits of this approach both from the perspective of building the EMS and then maintaining it in the long run.

Consider:

The way the organization is physically laid out and also functions as an organization.

The kind of businesses they are in and how they interact with the rest of the world.

For a presentation describe in a few bullets how your group would ensure that such an EMS would work in general terms across all of ALU.

Exercise 1

Group 3

Your task is to consider arguments for separate EMSs based on a common model for each of the four generating plants.

Based on the information you have on ALU and would expect to find, what are the benefits of this approach both from the perspective of building the EMS and then maintaining it in the long run.

Consider:

The way the organization is physically laid out and also functions as an organization.

The kind of businesses they are in and how they interact with the rest of the world.

For a presentation describe in a few bullets how your group would ensure that the individual EMSs would work across all of ALU in general terms.

Exercise 2 Overall EMS Design

Part A

You have now been assigned a part of ALU to act as their internal EMS expert.

Group 1 will be implementing an EMS for the Fossil Fuel Fired Generating Stations, TEG1 and TEG2.

Group 2 will be implementing an EMS for the Hydroelectric Generating Stations HG1 and HG2 and their associated control structures and facilities.

Group 3 will be implementing and EMS for Transmission, Distribution, and Corporate functions.

In order to conduct Pre-Implementation Activities for your EMS you will need to:

- Define the Scope of the EMS.
- Select a Project Champion.
- Select a Core Team and decide what their function will be versus your Project Team.
- What form of a Gap Assessment will you do?
- Do a preliminary outline of the Structure, Roles and Responsibilities at the management level for the EMS.
- Complete an overall Implementation Project Plan, including the Budget and Schedule.

The time allotted for this exercise is limited so prioritize which of these activities is of greatest importance to your EMS Implementation and proceed.

Exercise 2 Overall EMS Design

Part B

Make recommendations for revisions if any to the existing Environmental Policy.

The existing Environmental Policy is as follows:

ALU Environmental Policy

We, at ALU Inc., are committed to conducting our business in an environmentally responsible manner. We will be a global leader in environmental protection, which is integral to our continuous improvement process. This process is aimed at meeting the expectations of our customers, employees, shareholders and the communities in which we operate.

Commitments:

We will continuously strive to minimize our impact on the environment by establishing and maintaining objectives and targets aimed at:

- Waste minimization; and
- Conservation of resources.

We will participate in government, industry, and community initiatives.

We will document, implement, maintain and communicate this policy to all employees and make it available to the public.

We will evaluate the effectiveness of our environmental management system through periodic audits and reviews, with the overall aim of continually improving our environmental performance.

PLANNING

Exercise 3 ASPECTS and IMPACTS

For ALU

Based on the description do the following:

- Identify several major activities, products, or services (within the scope of your EMS).

- List the aspects and associated impacts related to these activities.

- Be sure you look beyond the core processes of your organization.

Exercise 4 Significance

The Detailed Aspect and Impact lists you have just been provided with are slightly dated and from a number of real utilities of which ALU is loosely modeled. Selected pieces have been adjusted for confidentiality reasons. These lists are a good start but are not actually complete lists. Quickly review the lists to observe both the direct process related aspects and non-process related ones.

Note: Your facilitator has actually been to and worked with all of the organizations from which ALU is modeled. If there are any questions about some of the technical terms imbedded in the aspect lists, please ask.

Part A

Please consider the following:
- All of what you now know about ALU;
- The EMS design work from previous exercises;
- The discussion on significance; and
- The reading materials you were given ahead of time.

Describe an appropriate significance procedure for ALU.

Part B

Select 2-3 aspects from the aspect list you were given and apply the procedure.

Exercise 5 Objectives and Targets

You have been authorized by senior management to establish Objectives and Targets (which will lead to new or improved management programs) for five of the identified significant aspects. You get to choose the objectives and targets, but have been asked to limit it to five in the short term in order to focus the effort on an achievable level.

Make your selections, record them and the key rationalization points for each. Next describe and how your objectives and targets work within ALU's Policy. Be prepared to defend to the EMS Core Team and to Senior Management your selection of aspects and the Objectives and Targets.

Exercise 6 Environmental Management Programs (EMPs)

Define EMPs for the Objectives and Targets established in Exercise 4 taking into account the feedback the EMS Core Team and Senior Management has provided. . Senior Management has stipulated that you provide detail on how these programs will affect both daily and long-term facility operations. In addition, Senior Management wants to know how much they will cost both in staff time and dollars. What else does Senior Management need to know to support these programs? What is their role in the program?

The form on the next page may be of some help but feel free to create an ALU format.

Figure 6-1: Sample Environmental Management Program Form

(Note: Use one form per EMP)

Date (_____/_____/_____) **Individual Responsible:**
Environmental Objective(s):
Related Target(s):
Related Significant Environmental Aspect(s):
Specific Function and/or Department:
Target Date (Month/Year): (_____/_____)
Environmental Management Program: Action Plan
How will this objective be met? (attach additional pages as necessary)
What operational controls might support the achievement of this objective?
How will this objective be tracked? (attach additional pages as necessary)
What resources will be required to achieve this objective? (attach additional pages as necessary)

Exercise 7

You have been working on the EMS Implementation Project for 4 months.

A financial crisis in the company may be looming. Over the past 4 months while you have been planning the EMS, the price of natural gas has tripled and coal prices are up by 30% just as ALU is starting negotiate its next set of long-term contracts. The contracting group needs to be sure it can forecast demand with a high level of accuracy. In the past when the coal fired stations where on base load year round this was not hard to do. But the added dynamic of a general commitment by TEG2 to the community to use ever increasing amounts of natural gas instead of coal is making this harder since TEG2 is no longer considered the most cost-effective means of generation.

As you have been developing your new programs for the EMS the International Brotherhood of Power Workers, (the Union for the original utility), realize that the operations of the plants will begin to change more and more over time. This is especially true since ALU just announced that it is going to follow the EMS project with a Quality Management System (QMS) initiative that it plans to integrate with the EMS. The QMS decision was made when the senior managers of ALU realized that with a change in administration at the State Legislature, deregulation of the industry is going from a back burner issue to a top of the new administration's agenda. Competition is about to increase, and efficiency and cost-cutting will be the name of the game for the next two years while the market you operate in becomes fully deregulated. The Union, fearful of job losses, is already making noise with the current contract set to expire in three months. With a possible strike over job security is on the horizon,, line management is now focussed on making sure that the plants will be operational in case of a strike. Management is working on resource issues in the event of a strike, while the Union staff have been directed by their stewards to keep a close eye on what is up.

At a corporate level, the board of directors has been instructed by the CEO to pursue both possible reorganization to facilitate either divestitures or acquisitions as the market prepares for increased competition. At a minimum ALU will likely need to create several more isolated operating groups in the future since the most likely deregulated scenario will see some form of market place created where consumers can choose whatever power source they want to buy from and then have it delivered over the existing set of lines.

With these developments what do you see as the effects on you EMS Implementation Project? What strategies are you going to have? Keep in mind that you have been in-formed that the EMS project still needs to move ahead since it is the leader to be followed in the future by a QMS project both of which are key building blocks to longer term viability of ALU. You have also been provided with some detail on actual objectives, targets and EMPs for the aspects of ALU. Use these to assist you in understanding how the real utilities in which ALU is based approached these problems. Feel free to stay with your EMPs or use these.

Exercise 8 EMS Procedures, Documentation and Records

How will you organize your EMS documentation? To help answer this question, consider:

- What sort of backbone for the EMS is needed your division of ALU? For any electronic solutions describe the characteristics of the system?

- What pieces of information will you include in your format for each level of procedural documentation and how will you organize the information?

To help you start, write down a list of the types of things that you will need to document, and how you plan to manage them.

If time allows, prepare a draft of a procedure at each level of documentation in association with one of your significant aspects (the key here is not some much the technical content of the procedure, document, record, or form itself but how the different pieces will work together in the context of the EMS).

To get you started here are some notes:

LAYOUT NOTES FOR EMS PROCEDURES

When writing EMS procedures it is often a good idea to have a standardized format. The result of having a standardized format is that there is a certain level of recognition associated with the procedures. The suggested layout below should first serve as content guide. When developing your plant's procedural format, use one that will cause a minimum of disruption in your plant. Format is entirely at the user's discretion.

Each plant should decide where it needs to have documented and formalized procedures and where it does not. As a general rule of thumb, if your plant has determined that without a written procedure there is an unacceptable risk of the activities being conducted incorrectly then a written procedure is a good idea. The procedure examples provided in the sections and appendices of this document provide a detailed level of documentation. Some plants may find that a less in-depth level of documentation is sufficient.

This example includes building blocks for an Environmental Aspects Procedure.

ABC CO ENVIRONMENTAL MANAGEMENT SYSTEM MANUAL

Title: Environmental Aspects Section: # 0.0

Version 1.1
Ref. ISO 14001:96 4.3.1 Issue Date: 00-00-00
Revise by 00-00-00

Note: Using dates for revision and version numbers helps in the process of document control and ensuring that users have the correct procedure in hand.

ABC Meat Processing Environmental Policy

Reference to the section (s) of the Policy that are most relevant to this section.

ISO 14001:96 4.3.1 Environmental Aspects

Note: Since ABC CO is using ISO 14001 as the model for its EMS, it is using the content of the standard as a reference against which it can cross references specific procedures.

The organization shall establish and maintain (a) procedures(s) to identify the environmental aspects of its activities, products or services that it can control and over which it can be expected to have an influence, in order to determine those that have or can have significant impacts on the environment. The organization shall ensure that the aspects relating to these significant impacts are considered in setting its environmental objectives.

Purpose

Needed here is a short description of the purpose for this section and what is to be included in this section. This description may serve as a quick reference to describe the contents of the section.

Scope

The scope briefly describes to what areas of the business does this procedure apply. Any exceptions may be noted here.

Definitions

Any terms that require explanation would be defined here. It is important to define any necessary terms near the start of the section so that the reader is introduced to these terms and is made aware of their meaning. A reference is usually provided for any given definition.

Responsibility

This section is needed to identify specific personnel within the organization that have some responsibility in developing, executing the related procedure and making sure it is kept up-to-date. Those personnel responsible are normally listed in a 'top-down' format beginning with those positions of 'upper management' down to those at an operational level. If certain environmental programs assume some responsibility for tasks related to the procedure, they would also be listed and described here. This listing is necessary to clarify any discrepancies regarding responsibilities but may also serve as a reference for any personnel requiring additional assistance related to the procedure. Noting responsibilities in procedures is one way to ensure that responsibility and authority are understood and this serves as a building block for an overall summary of responsibilities associated with the EMS.

Core Content

This section would commonly be broken down into a series of logical steps. Where applicable, the use of charts and flow diagrams would be used to represent a step of the procedure. A sequential listing of activities to be completed as part of this procedure can serve to simplify the process by breaking down a rather complex topic into manageable units.

For the Aspects Procedure the following series of steps might be used

Step 1 - Identify Activities, Products and Services
Step 2 - Identify Environmental Aspects
Step 3 - Identify Associated Environmental Impacts
Step 4 – Grouping of Aspects

Review and Updating

This section sets out the need for periodic review of the procedure. Included in this section will be a general schedule for the review of certain tasks and will include in some cases the personnel responsible. Review and updating of procedures is necessary in order to comply with changing activities, products and services of the organization.

References

A list of references is needed for the appropriate documentation of information used in the section. References also serve as a resource that the reader may use if s/he requires any additional information.
The reference section is also a place to identify other EMS procedures that effect the activities within this procedure and other areas of the EMS that are linked to this procedure.

Example References for Aspects:

Legal and Other Requirements (needed for determining significance)
Objectives and Targets (uses results of aspect identification and significance process)
Emergency Preparedness and Response (potential emergencies lead to impacts)
Structure and Responsibility (who executes this procedure and provides input)

The next document is an adapted format from an actual utility.

Have a quick look to see the difference in level and style of detail.

EMS DOCUMENTATION

1.0 Purpose

This section describes the process for describing the core elements of the EMS, their interaction and providing direction to related documentation.

2.0 Scope and Applicability

This section applies to all areas of ABC Co. business. There are no exceptions.

3.0 Roles and Accountabilities

Director, Environmental Affairs Sub-Division
- Perform as the Senior Environment Program and Control Executive responsible for the management of ABC CO's environmental programs.
- Develop programs and monitor implementation (as Content Authority) for: Environmental Program and Control Management System (ISO 14001 consistent).
    - Prepare/approve EMS documentation

EMS Representative, HQ
- Maintain the HQ EMS
- Maintaining this section and the entire HQ EMS manual

4.0 Description

4.1 EMS Manual Distribution

The EMS Manual is the key document of the EMS. It references all EMS policies, procedures and reports that are related to HQ. The HQ EMS Manual is a controlled document and only the Director of Environmental Affairs, HQ can create/revise original copies. The master copy of this EMS Manual is maintained by the EMS Representative, HQ; others are distributed according to the distribution and access criteria.

The paper copies are distributed to the following individuals or functions according to the process described in Section A-4 – EMS Manual Distribution of this Manual:

- EVP/CNO, ABC CO
- VP, ops
- Director of Environmental Affairs, Corporate
- All VPs and Directors, HQ
- Director of Environmental Affairs, HQ
- EMS Representative, HQ
- All Site, VPs
- ABC CO General Counsel

Accountability for the periodic review of the manual and other controlled EMS documents is cited on each document (See Section A-5 – EMS Manual Revision History in this Manual).

The paper and electronic copies are controlled according to the process described in Section C-5 – Document Control of this Manual. Paper copies are controlled in accordance with PROC-003, Controlled Document Management. The electronic version will be made available to all staff through the Controlled Documents Module of Passport.

HQ relies on many documents to support its EMS. The major ones are listed in Section C-5 – Document Control along with their key characteristics. For example, some of these documents spell out regulatory or other environmental requirements while others are operational control documents. Most of the documents listed are ABC CO in origin, but there are also those that have been adopted for use from corporate or other sources external to ABC Co.

4.2 Information on the Core Elements of the EMS and their Interaction

HQ maintains information in both paper and electronic form to describe the core elements of the EMS and their interaction. Paper documents and records are directed to the ABC CO records center at HQ. Electronic documents created in the past have been stored in the existing "Foremost" documentation tracking system located on the Local Area Network. The Foremost system is in the process of being replaced by an improved system, the "Passport" system. The conversion of all existing Governing Documents and Controlled Documents to Passport is

underway but not complete at this time. Each controlled document will be present in one of these two systems only. All new controlled documents are being stored electronically in the Passport system. The Passport system will accommodate both electronically editable files such as this manual as well as documents, which originate from sources outside of ABC CO and are then scanned into electronic memory.

The EMS Manual is the key document of the EMS. It references all EMS policies, procedures and reports that are related to HQ. The paper copies of this manual are controlled by distribution (see Section A-4) and in accordance with PROC-003, Controlled Document Management. The electronic version will be made available to virtually all HQ staff through the Controlled Documents Module of Passport.

Passport as an electronic storage medium has the ability track the dates that documents were last modified. When documents are entered into Passport a review by date should be included. For EMS related documents Passport will be requested to identify a review schedule and report on the maintenance of documents versus this schedule.

5.0 References

PROC-003, Controlled Document Management.

Controlled Documents Module of Passport.

NOTE: Remember to keep in mind that EMS procedures are only one level of documentation.

Exercise 9 Operational Controls, Monitoring and Measuring

Part A

You have developed a number of EMPs, what operational controls do you envision?

Think about what key points are needed to control an aspect of the operation in order to manage or reduce the associated impact (s) of concern.

Remember to balance the need for improved performance against unnecessary complexity.

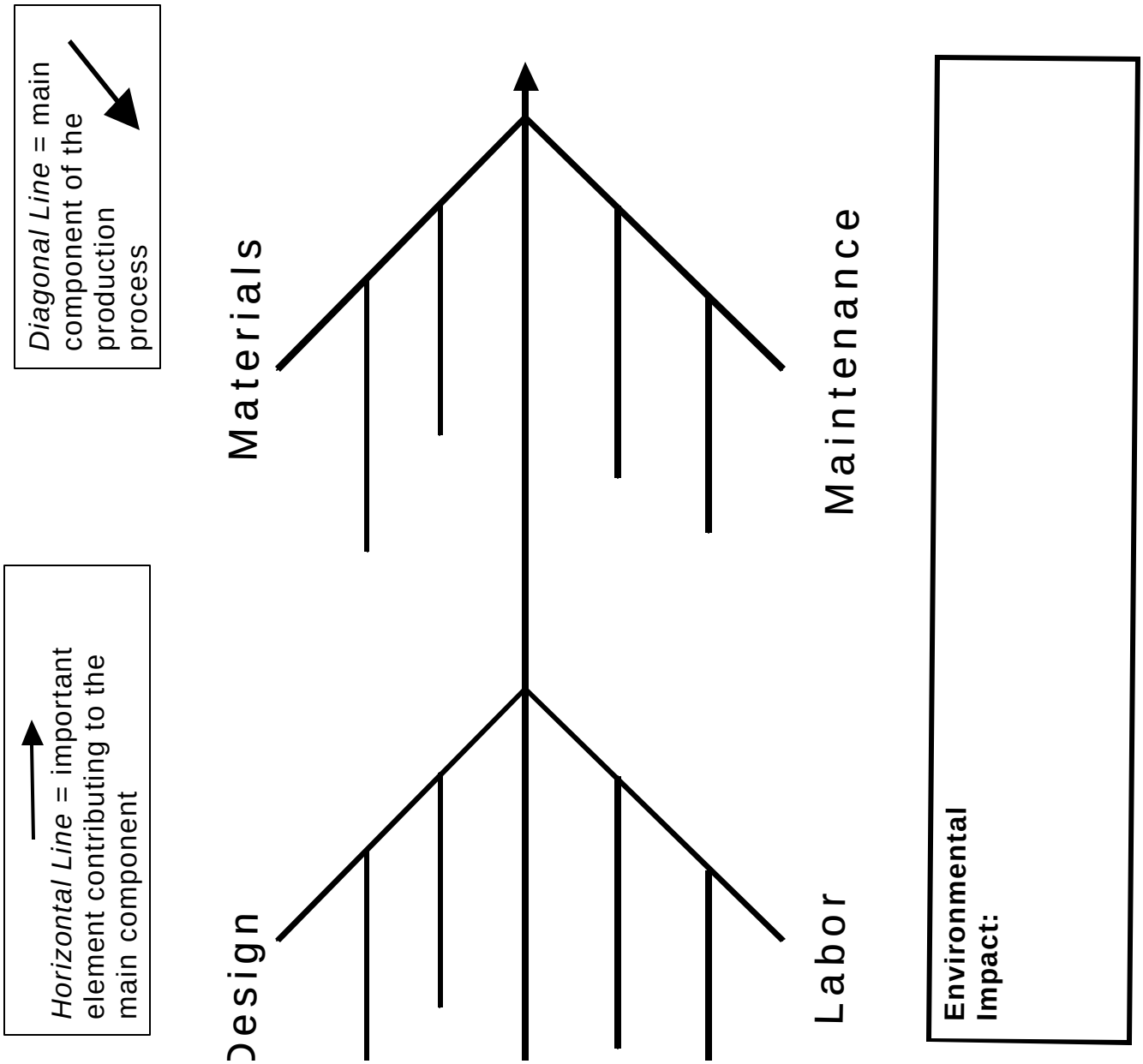
Do a first cut at your operational control procedures and then work with the operating level management and staff to ensure that the controls accomplish their piece of the EMP.

The next page provides a sample format for noting operational controls. A fishbone diagram is also included for your use.

EMS Operational Control Procedures

Significant Environmental Aspects	Indicator(s)	Associated Job Functions	Existing Operational Control Procedures	Operational Control Procedures Development/ Modification Needed	Responsible/ Status	Location Posted

Contact Person: Date Completed


Diagonal Line = main component of the production process
Horizontal Line = important element contributing to the main component
Materials
Maintenance
Design
Labor
Environmental Impact:

Exercise 9 Operational Controls, Monitoring and Measuring

Part B

For the same aspects / EMPs in Part A also consider what monitoring activities are needed. Describe how the information needs to be collected and used.

Part C

The monitoring and measurement you asked to define to date was specifically in relation to aspects and their EMPs. What other M and M might be needed for your EMS?

Think in general terms and consider all parts of the EMS at all levels of the organization.

Exercise 10 Corrective and Preventative Action

For your part of ALU describe how this process should work.

Be sure to consider:

- Ways in which the need for corrective actions will be identified;
- Different types of such actions;
- How you would identify root causes;
- Ways in which preventative action opportunities will be identified; and
- How to track these through to completion

Use your understanding of ALU s operations, the measures you have been building into other parts of the EMS, and the EMPs to create your corrective and preventative action process. Be sure when describing your process to consider how you will work within these structures to ensure that the right actions get identified and that they are carried through to completion.

Exercise 11 Continual Improvement

You have a variety of continual improvement activities and opportunities in your EMS. Where will evidence of this be found for the various elements of the EMS? Once you have made your "list" be prepared to explain to another group how the EMS you have spent the better part of 2 days developing will encourage continuous improvement. The group you will be discussing this with will be playing the role of a third party, who has been asked by senior management to determine if the EMS is and will continue to drive and assist the organization towards improvements in environmental performance.

Type of Evidence of Continual Improvement	Details